

No. XI.—NOTES ON THE CARBONIFEROUS BRACHIOPODA OF SCOTLAND, WITH A REVISED LIST OF THE GENERA AND SPECIES. BY JOHN YOUNG, F.G.S., *V.P.*

[Read 11th March, 1886.]

IN the present paper I offer a report to the Society on our present knowledge regarding the genera of Carboniferous Brachiopoda found in Scotland, with remarks on their shell-structure and other external and internal characters; also a revised list of the Scottish species, as determined by the late Dr. Davidson and printed in vol. 5, part 3, of his "Monograph of the British Fossil Brachiopoda," for the Palæontographical Society, London, 1884.

During the period of time embraced in the researches of Dr. Davidson, in connection with this monograph, extending from 1851 to 1884, an immense amount of knowledge has been gained not only of the genera and species of the Brachiopoda found within British strata, but likewise of those found in other countries of the world, as well as of those still living in recent seas. In the preface to the first volume of his work, 1853, Dr. Davidson writes thus of the group:—"Of all the species composing the sub-kingdom mollusca, none are, perhaps, more varied, more elegant in shape, or more abundantly distributed than those to which the term Brachiopoda or Palliobranchiata has been applied. They are found in the oldest deposits at present known to contain vestiges of animal life, and have continued to exist, some in similar, but many under different shapes to the existing forms, through the long successive periods which lead to the present time. Their full value to the geologist is consequently very great; and, as they so frequently fall under his hammer where other classes are often but sparingly represented, they must therefore be looked upon as excellent data for the age of the deposit; for, although some few individual forms pass from one stage to the other, the generality are limited to defined horizons."

It was not until 1857 that the British Carboniferous Brachiopoda came to be taken up by Dr. Davidson.\* At that time the whole group existed in a state of great confusion and in a badly determined condition both as to genera and species. You will better understand this confusion and multiplication of names from what

\* Second volume of the work.

Dr. Davidson states.\* “ At the time I commenced my researches, about 260 so-termed British Carboniferous species of Brachiopoda had been recorded by different palæontologists ; but, after a most searching investigation, I could not conscientiously admit more than about 100 of these, and in order to arrive at such a reduction no small labour was required, nor was I unmindful of the danger palæontologists should guard against in the breaking down of species, which, if injudiciously done, would be as great an evil as that of uselessly multiplying them.” He further states, in the same page, that Professor Morris, in his “ Catalogue of British Fossils, 1854,” had recorded 193 species of Carboniferous Brachiopoda, of which he had retained only 93. Professor Phillips had enumerated 100 species as found in Carboniferous strata in England, of which he had retained only 52 ; while of 250 species recorded by Professor M’Coy and Mr. Kelly from the same formation in Ireland, he says :—“ My most strenuous efforts have not shown the existence of more than about 80.”

In Scotland at that time comparatively few Carboniferous Brachiopoda had been recorded. For the British Association meeting at Glasgow in 1855 I prepared a MS. catalogue of the Carboniferous fossils from Western Scotland, then exhibited to the members. In the list of Brachiopoda there were 43 named and 14 unnamed species, in all 57 species. Of the 43 named species only 23 are retained in Dr. Davidson’s revised list, the rest being held as only varieties, or have since been more correctly determined to belong to genera and species not then known to have been found in Scotland. During the preparation of Dr. Davidson’s monograph of Carboniferous species, and since its completion in the supplementary volume, the list of Scottish species has been very much increased, chiefly through the efforts made by members of this Society, in the careful exploration of all the strata known to yield Brachiopoda and other marine forms ; and the revised list now shows † that there have been found in Scotland 59 species and 17 named varieties, several of the latter being now held to be good species, and given as such in the concluding volume of the monograph, 1884. These are now found to belong to 19 distinct genera, instead of some 7 genera, the number amongst which the group was formerly divided. Dr. John J. Bigsby, in his “Thesaurus

\* “ Carboniferous Brachiopoda,” p. 211.

† Carboniferous Brachiopoda, Supplement, pp. 257-261.

Devónico-Carbonarius, 1878," gives a list of the species of Carboniferous Brachiopoda from the various countries of the world recorded up to that date, and numbering 939. Dr. Davidson, in remarking on this list, says\* :—" Out of this number I find that some 143 species and a few named varieties have been described by myself from Great Britain. Although the total number of 939 will no doubt have some day to be very considerably reduced, still it will show how numerous and varied were the species of Brachiopoda that lived during the Carboniferous period, and especially so during the deposition of the Limestone series and its accompanying Shales."

In my remarks on the genera of Carboniferous Brachiopoda found in Scotland, I shall follow the arrangement given in Dr. Davidson's revised lists, in which the Tretenterata precede the Clistenterata, these being the two groups into which the Brachiopoda are now arranged by zoologists according to their internal organization.

#### TRETENTERATA.

*Lingula*.—This interesting genus, forming one of the oldest and most persistent types of the Brachiopoda which have descended to us from the earlier fossiliferous formations, is represented in the Carboniferous strata of Scotland by four species, of which only two are common, viz., *L. squamiformis* and *L. mytiloides*. These are found to range from the lower Calciferous sandstone series, up through the several divisions of the limestone strata, into that of the millstone grit and upper coal-measures, while *L. mytiloides* seems to have lived on into Permian times, in which formation it is known as *L. Credneri*. In the purer beds of limestone in the Scottish coal-fields, *Lingula* is rare, but it abounds, especially *L. squamiformis*, in certain of the shales which alternate with the limestone series. In the Glasgow coal-field, in the group of lacustrine strata embracing the lower coals and ironstones which lie between the lower and upper limestones, the two species above-named are often seen to crowd certain horizons of black, carbonaceous shales, having flourished apparently under conditions of water not favourable to the growth and development of any other marine organisms. On one of these horizons, viz., that overlying the lower Possil ironstone at Keppoch, north of Glasgow, *L. squamiformis* attained a size of one inch and a half in length, examples being figured by Dr. Davidson in his monograph as

\* Carboniferous Brachiopoda, Supplement, p. 253.

the largest he had seen from British strata. On another, higher horizon, in the same group of strata to the north of Glasgow, on the sinking of a pit at Robroyston, to the upper Possil ironstone, there were found numerous examples of *L. squamiformis* and *L. mytiloides*, which were standing erect in the strata in the position they had lived and died in and with their valves united. So finely were their surfaces preserved that Dr. Davidson stated in a letter to the author, that they were the best preserved fossil *Lingula* he had ever seen. So abundant are *Lingula* in other portions of the Lanarkshire coal-field that the late Dr. Rankin, of Carluke, in his table of the strata in that district, designates two beds in the series as the *Lingula* limestone and the *Lingula* ironstone.

The shells of *Lingula*, and those of *Discina* next to be noticed, differ in their mineral composition from those of most of the other genera of Brachiopoda in being corneous, or having a horny or chitinous structure. This character serves to distinguish them from other shells, even when they occur as fragments. Specimens of *L. mytiloides* from Scotch strata, showing remains of colour markings, have been described by Mr. Robert Etheridge, jun., and by myself. This shell is also often found with a fine bluish tint in the East Kilbride beds.

Regarding the other two Carboniferous species found in our strata, *L. Scotica* and *L. Thomsoni*, I have only to remark that both are rare. *L. Scotica* is a large species and is remarkable for its triangular shape. It was first found by Dr. Rankin in the Gare limestone shales, Carluke, and by Dr. Slimon in two localities in Lesmahagow parish. I have also found it in the Boghead shales near Hamilton; and more recently Dr. Davidson has figured one or two large and fine examples from Redesdale, in Northumberland.\* *L. Thomsoni* is only as yet known from Carboniferous limestone strata, in Tirfergus Glen near Campbeltown, where it was discovered by Mr. James Thomson. I have very great doubts about this shell belonging to the genus *Lingula*. It shows no trace, in the examples that I have examined, of that peculiar horny appearance of the shell so characteristic of other species of the genus. Dr. Davidson, in his description, says nothing about the structure of the shell, beyond that it is "longitudinally and finely striated," and that he had only "seen two examples." One of my two specimens

\* Carboniferous Brachiopoda, Supplement, pl. xxx.

shows the striæ on the surface, but they both show what is not seen in *Lingula*, viz., that the beak is slightly turned to one side, as is often found in Lamellibranch shells, so that its appearance is more like that of *Posidonomya* than *Lingula*. This being the case, and the apparent absence of the corneous shell, incline me to place a point of interrogation against the generic name in the list, until its shell-structure is further examined in other specimens.

*Discina*.—This genus is represented in Scottish Carboniferous strata by two species, only one, *D. nitida*, being common and found ranging from the marine beds of the Calciferous sandstone series up to those of the higher coal-measures in the Lanarkshire coal-field. It is also believed to be identical with one of the species found in the Permian strata of England, where it is known as *D. Konincki*. It is rather a rare shell in most British localities, but in one or two horizons of the Scottish coal-field, in some of the limestone quarries, examples may be picked up by the hundred on the banks of weathered shale. One of these is the bed of shale separating Nos. 1 and 2 limestones of the Calderwood series, in the parishes of Blantyre and East Kilbride, where this species is found in excellent preservation and often of a larger size than elsewhere. The surface of the shell, like that of *Lingula*, as formerly stated, has a corneous or horny lustre, and is often met with of a bluish colour. Dr. Davidson has figured an example from these beds showing radiated, bluish colour-markings still remaining on the surface of the shell, and he has also been able to illustrate the interior of the valves from other specimens.

The other Scottish Carboniferous species, *Discina Craigii*, is rare. It was discovered by Mr. Robert Craig, of Langside, Beith, corresponding member of the Society, in the lower limestone series of the Dockra Quarry, Beith. Two examples were found, one of which is figured and described by Dr. Davidson as *D. Craigii*, Davidson.\* It measures one inch eight lines in diameter and is the largest species of the genus that ever came under Dr. Davidson's examination. Subsequently another example of this shell, one inch and three-quarters in diameter, was obtained by Mr. James Neilson from a cutting of the Union Railway, north-east of Glasgow, in a bed of sandstone containing marine shells, lying close on the horizon of the upper limestone with the millstone grit series of

\* Carboniferous Brachiopoda, Supplement, pl. xxx., fig. 14.

that district.\* This species is not known from any other locality in our strata.

*Crania*.—The shells of this genus are often seen to assume various shapes, according to the form of the surface to which the lower valves are attached, but on the whole they have varied little in external form from their first appearance in the fossiliferous strata down to the present time. In the Carboniferous rocks of Scotland the genus is represented by only one species, *C. quadrata*, which is seemingly restricted to the strata of the lower and upper limestone series. In Scotland, as well as in England and Ireland, it is rare on most horizons, but in the shale of the Calderwood limestone series it is specially abundant, as at Capelrig Old Quarry, East Kilbride, where it is found clustered upon shells and stems of crinoids in a very interesting way. I possess a stem of a crinoid two inches long and one half inch in diameter on which there are remaining no fewer than sixteen examples of the lower or attached valve. These are seen to be, in some instances, so close together that the edges of shells, where they impinge upon one another, have often interfered with their shape and regular growth. Very good examples of the interior of the valves are found in this horizon, and from those Dr. Davidson has been able to illustrate the muscular impressions. The shells of *Crania* differ from those of *Lingula* and *Discina* in being calcareous, and when well-preserved, the upper or free valve is found to be minutely perforated, as is the case in many other genera of Brachiopoda. In the lower valve I have found no trace of perforations, and was therefore led to examine the lower or attached valve of *C. anomala*, the only living British species. I found in it very few visible perforations compared with those to be seen in the free valve, although it has been supposed that both valves were perforated alike. Had the lower valve of *C. quadrata* been perforated to any extent I could hardly have failed to have observed the fact in some of the numerous specimens I have examined, especially as in those specimens the perforations of the upper valve are well seen.

#### CLISTENTERATA.

*Dielasma (Terebratula)*.—The researches made during recent years into the internal characters and other points of structure in that extensive group of the Brachiopoda which now forms the family

\* *Transactions*, vol. v., p. 227.

of the *Terebratulidæ* have led to the formation of several sub-genera. The *Terebratula* of the Carboniferous and other palæozoic strata are now placed in the genus *Dielasma*, of King, from their possessing septal and dental plates within their shells. According to Dr. Waagen (whom Dr. Davidson quotes in regard to these new sub-genera of the Brachiopoda), the genus *Dielasma* appeared first in the Devonian and continued up through the Carboniferous and Permian formations into the lower Trias, where it seems to have become extinct, and to have been replaced by another type or sub-genus of *Terebratula*. In Scottish Carboniferous strata, *Dielasma* is represented by four species which were at one time considered by Dr. Davidson to be only varieties of one type, *D. sacculus*, Martin; but in his revised list they now rank as species. One of these, *D. hastata*, is found in strata of the Calciferous sandstone series in the East as well as in the West of Scotland, but it is in the strata of the lower and upper limestones that they have been found most frequently, although they are everywhere rather rare shells.

None of the Scottish examples ever seem to have attained a length of more than one inch, and this dwarfed condition is also characteristic of several of the other genera of the Clisterata found in Scotland, when compared with the larger and similar forms from the Carboniferous strata of England and Ireland. In the limestones and shales of the Beith district, as well as in those from the Brockley district, there are found numerous examples of a small race of *Dielasma*, chiefly *D. sacculus*, few exceeding one-fourth of an inch in length, while many are less than a line in diameter. The perforations characteristic of the shell-structure are often well preserved, especially in examples found in shales, and this character enables the genus to be easily recognized, even in strata where the shells are frequently found in a crushed and fragmentary condition. Specimens showing the interior of the valves are sometimes found in these shales, but they are very rare.

*Spirifera*.—This genus, which forms the type of the family Spiriferidæ, has now been divided into several sub-families and sub-genera, some of which fall here to be noticed. Of ten species of *Spirifera* recorded from the Carboniferous strata of Scotland in Dr. Davidson's former lists, only five are now retained, one found at Gillfoot, Carlisle, a single valve of *S. triangularis*, in the late Dr. Rankin's collection, being, however, very doubtful. This speci-

men appears to me to be only a portion of the extended hinge-area of a rather wide example of *S. trigonalis*, such as is found in the shale of the same locality. This last-mentioned species and its variety, *S. bisulcata*, are by far the most widely distributed members of the genus within the coal-fields of Scotland, ranging from the Calciferous sandstone series up into the strata of the lower and upper limestones. *S. trigonalis*, the type species, presents us with several interesting and well-marked varieties, to which I formerly called attention in a paper read to the Glasgow Natural History Society, \* noticing their vertical range and distribution within our coal-fields. I have also, in a more recent paper "On the denticulated structure of the hinge-line of *S. trigonalis*," † described the interesting character which, in specimens derived from our limestone shales, I discovered in connection with the hinge-area of this species. This character is also figured and described from the same specimens by Dr. Davidson in his Monograph, ‡ and in those notices fuller information regarding them may be had.

*Martinia (Spirifera)*.—The species forming this sub-genus are now characterized by having a minutely perforated shell-structure, whilst those of *Spirifera* proper are not known to be perforated. This perforated character, as pointed out by Dr. Davidson, was not known to Professor M'Coy, when, in 1844, he proposed the genus *Martinia* for some of the *Spirifera* now there placed, doing so on the mistaken supposition that their spiral appendages were small, although Dr. Davidson has since shown this is not the case. There are amongst Scottish specimens of the genus very few examples which now show any trace of those minute perforations, but this is believed to be due to alteration of the shell-structure from fossilization. Dr. Davidson states that according to Dr. Waagen the punctured epidermis seems to be more easily destroyed in the shell of the true *Martinia* than in those of the sub-genus *Martiniopsis*, in which it is much better preserved and therefore more frequently found. Since that period I have discovered perforations in *S. ovalis*, which is closely allied in form to the genus *Martinia*, and is now placed with it in the list of species. On communicating this fact to Dr. Davidson, he wrote, Jan. 26th, 1885: "I am glad that you have found perforations in the shell of

\* *Proceedings*, vol. iii., p. 373, 1876.

† *Geol. Mag.*, decade iii., vol. i. 1884, p. 18.

‡ Vol. v., part iii. 1884, p. 373.

*Spirifera*, or rather now *Martinia ovalis*. It did not surprise me to learn that you had found them, and I think it is quite right to separate the perforate from the non-perforate species." The specimen showing these perforations is a finely-preserved though small example from the limestone shales of the Brockley district, and I hope this structure will yet be found in other specimens.

On many Scottish examples of *Martinia Urei* (formerly *Spirifera Urei*), besides the covering of minute spines on the surface of the shell, which was first illustrated by Dr. Davidson from Scottish specimens, there is to be seen a beautiful reticulated ornamentation confined to the inner surfaces of the valves and the surfaces of casts. I have also found this structure in other Scottish Carboniferous Brachiopoda, and as it might be mistaken by some to be a kind of perforation of the shell-structure, I may explain that it is due to the cropping out on the inner surfaces of the valves of the bundles of shell-fibre which compose the structure of the shell, and which, in their oblique or inclined passage through its thickness, produce the imbricated arrangement of the ends of the bundles spoken of. This structure has been examined by the late Dr. Carpenter and others in recent Brachiopods, and examples of it are illustrated by Dr. Davidson in his monograph.\*

*Reticularia* (*Spirifera*).—In Dr. Davidson's lists this sub-genus is represented from British Carboniferous strata by only one species and two named varieties. The genus extends from the Devonian up into the Carboniferous limestone series, and in Scotland is found ranging from the Calciferous series into the lower and upper limestones, but it is not very abundant in any of its localities.

The genus *Reticularia* was first proposed for this species and its varieties by Professor M'Coy in 1844, from the reticulate markings seen on the surface of the shell, but the name was not then adopted by palæontologists. It has, however, been revived by Dr. Waagen, and is now accepted by Dr. Davidson, owing to the discovery on the shell-surface of new characters, only recently observed, and not known to M'Coy or Davidson. These new characters were first noticed in 1880, and are now figured and described by Dr. Davidson in his monograph,† and may here be shortly mentioned,

\* Vol. i., parts v. and vi.

† Carboniferous Brachiopoda, Supplement, vol. iv., pl. xxxiv., fig. 9, p. 275.

as consisting of a series of barbed spines, arranged in concentric lines, upon the surface of both valves. These spines were hollow, and consisted of two tubes, as in a double-barrelled gun, which ended in two small pores on the surface of the shell. The bases of these spines have produced the reticulations on the surface from which the genus now takes its name. The hooklets on the spines are arranged in two parallel rows, and their points are directed towards the free ends of the spines, or away from the shell. This structure I first discovered in a specimen from the Blantyre shales, and I have since observed it in examples from other localities. The characters here noticed have not yet been observed in any other Brachiopod shell, recent or fossil. I have also found, in a specimen from the Brockley shales, that this genus is further characterized by having a minutely perforated shell-structure, as in *Martinia ovalis*.

*Spiriferina*.—This genus is represented by four species in the Carboniferous strata of Scotland. The most common species, *S. cristata*, variety *octoplicata*, is found in certain of the marine beds, ranging from the Calciferous series up into the lower and upper limestones. Another species, *S. Etheridgei*, Dr. Davidson found at Fullarton quarry, near Temple, Midlothian, in the lower limestone, and it has not yet been identified from any other locality in Britain. None of the species are common in any of the localities in which they are met with. They are readily recognized from species belonging to the true *Spirifera* by their strongly perforated shell-structure.

*Athyris*.—Four species belonging to this genus have been found in Scotland. One of these, *A. pisum*, Davidson, a small form got by Mr. James Thomson in the lower limestone shales at Brockley, has not yet been met with in any other locality. The most abundant species, *A. ambigua*, seems also to have had the greatest vertical range, being found in strata extending from the marine beds of the Calciferous series up into those of the lower and upper limestones. Several varieties of this species are found, and are well illustrated in Dr. Davidson's monograph. Another species, *A. Royssii*, is also moderately common in the lower limestone shales of the Beith and Brockley districts, where specimens may be picked up, showing the numerous concentric rows of flattened spines which completely covered the surface of the shell, and so characterize this species. The shells of the genus *Athyris* are not

known to be perforated in their structure, and may thus be known from shells belonging to the Terebratulidæ, but the fibrous bundles of their shell-structure sometimes form a reticulate ornamentation on the surface of casts, similar to that which I previously pointed out was seen on the casts of the shells of *Martimia Urei*, Fleming, and which might be mistaken for perforations.

*Retzia*.—This genus is the only other member of the Spiriferidæ yet found in Scottish Carboniferous strata, and is represented by only one species, *R. radialis*, which is found in both the lower and upper groups of limestones. It is a small shell, and is rare in all its localities, but may be known from shells of *Rhynchonella*, which it externally resembles in its form and ribbing, by having a minutely perforated shell-structure as in the Terebratulidæ.

*Rhynchopora*.—The shells of this genus externally resemble those of the Rhynchonellidæ, but are distinguished from them by having a perforated shell-structure. Only two species of the genus are yet known, one being from strata of the Permian formation in Russia, the other from the Carboniferous strata of the Beith and Dalry district in Ayrshire. At Bowertrapping there, where it was first discovered, it sometimes occurs in abundance in a gregarious condition in certain portions of the limestone, but is rare or absent in other parts of the bed. It has not yet been recorded from any other British limestone strata.

*Camaronophoria*.—This forms another genus of the Rhynchonellidæ, and is represented in Scottish Carboniferous limestones by two species, both rare, and only recorded from the lower beds. Externally the shells strongly resemble *Rhynchonella*, and I have no doubt that specimens may exist in collections under that name. They may be distinguished from shells of that genus by their converging dental plates, and by one or two other internal characters, which are rarely visible on the surface of the shells, but may be exposed by etching them with acids.

*Rhynchonella*.—This genus, the type of the family Rhynchonellidæ, is represented in Scottish strata by three species, one of which, *R. pleurodon*, ranges from the marine beds of the Califerous series up into those of the lower and upper limestones, but in the later deposits it became rarer, and generally of smaller size. *R. pugnus*, on the other hand, is more common in the later

deposits than in the earlier beds. The third species, *R. Brockleyensis*, Davidson, was found by Mr. James Thomson in the lower limestone shales of the Brockley district, where it is a rare shell, not having yet been recorded from any other locality in the strata of the Scottish coal-fields. I may here mention that the largest and finest examples of *R. pleurodon* I have yet seen from the strata of the West of Scotland are found in a bed of shale underlying the coralline limestone band at Corrieburn on the Campsie hills, but even there it is only about half the size of some of those from the English limestones.

*Orthis*.—This genus, forming one of the three members of the family Strophomenidæ found in Scottish Carboniferous strata, falls here to be noted. Though extremely abundant in species in the strata of the Silurian period, this genus is represented in British Carboniferous strata by only four species, one of which is doubtful. In Scotland two of the four species are found, one being *O. resupinata*, which ranges from the Calciferous series up into the lower and upper limestones, but is only moderately common in any of the localities. *O. Michelini*, the other species, is abundant in some of the strata of the lower limestones of the Beith district, where fine examples may be picked up showing the outer covering of spines, and the muscular impressions in the interior of the shell. The shell-structure of the genus is minutely perforated, that of *O. Michelini* showing perforations of various sizes. Dr. Davidson figures and describes\* what he terms a small variety of *Orthis resupinata*, with widely separated beaks, from Corrieburn, Campsie. This form is, I think, more closely related to the one he has figured as *O. Keyserlingiana*, De Koninck, than to the former species, although placed provisionally with it, but is probably a distinct species from either.

*Streptorhynchus*.—This genus is represented in Scottish Carboniferous strata by one species and three named varieties. *S. crenistria*, the type form, is found ranging from the Calciferous series into the upper limestones, and is extremely abundant in certain districts, as at Auchenskeoch, Dalry, from which locality Dr. Davidson in his Carboniferous monograph has figured examples, which measured from five to six inches in width, by three and a half inches in depth, being the largest yet found in British strata. The varieties of this species found in Scotland are more

\* Carboniferous Brachiopoda, pl. i., fig. 15.

rare, and more local in their distribution than the type form, some being confined to certain horizons of the upper limestone. In my examination of the shell-structure for Dr. Davidson, I found that the perforations were confined to the inner layers of the shell, and presented the same characters as those seen in shells of the family Productidæ.

*Strophomena*.—This genus appears to be represented by only one species and one named variety in the Carboniferous strata of Scotland. It is rather a rare shell, and has only been met with in strata of the lower and upper limestone groups. The perforations are confined to the inner layer of the shell, and are somewhat widely apart, lying in an inclined and slanting direction towards the beak. The most interesting and noticeable character observed in connection with Scottish examples of *Strophomena analoga* and its variety *Strophomena distorta*, and which Dr. Davidson was never able to explain, is the way in which the vascular impressions on the interior of the shell are seen to radiate in a continuous manner from the beak all over the inner surface, instead of forming a ring around the ovarian spaces, as had been already figured and described by Professor King and Dr. Davidson from examples found in the English Carboniferous limestone. Examples showing this peculiarity in the Scottish specimens were found in the Main limestone at Campsie and at Bowertrapping, near Dalry, one being figured by Dr. Davidson.\*

*Productus*.—Of all the genera of Carboniferous Brachiopoda found in Scotland, none so abundantly represents the group as that forming the family Productidæ, Dr. Davidson identifying no less than twenty-five species, including one or two named varieties. From the whole of the Carboniferous strata of Britain some forty species have been obtained, but this list includes also one or two named varieties. From the abundance of certain species in the strata of the Scottish coal-fields, some of the beds are known as the *Productus* limestone and shales. The genus ranges from the lower beds of the Calciferous series into that of the lower and upper limestones, millstone grit, and upper coal-measures, becoming, so far as known, extinct in the strata of the Permian formation. Whilst many of the species of *Productus* are very abundant in all the strata in which they are met with, others are very rare, being confined to a few localities and to certain horizons.

\* Carboniferous Brachiopoda, Supplement, pl. xxxvi., fig. 23.

The places where these have been chiefly found are noted in the "Catalogue of Western Scottish Fossils," Glasgow, 1876, and need not here be repeated. The most important characteristic noted by Dr. Davidson in connection with Scottish specimens of this genus is the light which they enabled him to throw upon the internal muscular impressions in the shells of many of the species, and also of the spines which were once adherent to their surfaces. These specimens were chiefly obtained from the shale beds and from the rotted limestones, and will be found illustrated in the Carboniferous monograph as well as in the later Supplement to it. While Dr. Davidson was engaged in his investigation of the group, I was also privileged to prepare for him examples of nearly all the Scottish species, to show the nature of the shell-perforations. Previous to this period very little was known of the shell-structure in *Productus*, and the work proved of greater interest than either of us anticipated when first taken up. We found that whilst the perforations in the shells of the *Productidæ* were all on a similar plan—confined to the inner layers of the shell and not passing to its external surface—yet they varied much in character in the several species. Some of these structures are illustrated by Dr. Davidson in the Carboniferous Supplement,\* and the species examined are described in the text. I have only further to mention in connection with *Productus* that an esteemed member of this Society, Mr. James Bennie, of the Geological Survey of Scotland, discovered at Skaterow Harbour and East Barns Quarry, near Dunbar, in the lower limestone series, a species of the genus which was adherent by its spines and often by one of its valves to crinoid stems, shells, and fragments of polyzoa. This very interesting form has been illustrated, described and named *Productus complectens* by Mr. Robert Etheridge, jun.† I have also to note the finding of a specimen of *Productus scabriculum* with a broad-margined fringe or band of about three-eighths to five-eighths inch in width around the outer edge of the shell. This character has sometimes, but very rarely, been noticed in connection with other species of the genus. The specimen in question I found in the limestone at Hillhead Quarry, Beith, Ayrshire.

\* Plate xxxvi.

† *Quarterly Journal of the Geological Society*, vol. xxxii., pls. xxiv-xxv. The description and figures are also reproduced in Dr. Davidson's Carboniferous Brachiopoda, Supplement, pl. xxxv.

*Chonetes*.—This genus is represented by four species in Scottish Carboniferous strata, and ranges from the Calciferous series into the lower and upper limestones. It is rare in the purer limestone beds, but in the alternating shales one or two of the species are abundantly met with in several localities in Scotland. The largest and most widely distributed species, *Chonetes Laquessiana*, is found in fine preservation in the shale which separates the Nos. 1 and 2 limestones of the Calderwood series, in the parishes of Blantyre and East Kilbride, Lanarkshire. From this horizon I have been able to examine the shell-structure of *Chonetes* in specimens of this species for Dr. Davidson, and it will be found figured and described in the Appendix to his Supplement.\* Previous to this examination little or nothing was known of the true nature of the perforations in *Chonetes* nor of the passages of the tubular spines on the hinge area of the ventral valve as pores which open to the interior of the shell. I was therefore much pleased to be able to reveal these structures in Scottish specimens, and to find that they closely agreed with those I had previously found in the Productidæ.

*Aulacorhynchus*.—This genus, the last in Dr. Davidson's list of Carboniferous Brachiopoda found in Scotland, is represented by only one species, *A. Davidsoni*, and was obtained from the limestone at Clatteringwell Quarry, Bishops' Hill, Kinnesswood, Kinross-shire, the specimens now being in the Museum of Practical Geology, London. This shell at first was doubtfully identified by Dr. Davidson as belonging to *Chonetes concentrica*, De Koninck, and is figured and described by him as such in the Appendix to his Carboniferous monograph.† In the Appendix to Supplements,‡ Dr. Davidson again refers to this shell, and states that it also had been found, along with other species of *Aulacorhynchus*, in the Asturias, a province of Spain, and that the Scottish form had received the name of *A. Davidsoni*, Barrois. The genus is also found in American Carboniferous strata, but since Dr. Davidson described the shell no other examples seem to have been found in Scotland or elsewhere within the British Isles.

I have only further to remark before concluding these notes that there is not much likelihood of the list of genera and species

\* Vol. v., pl. xx., pp. 280-283.

† Vol. ii., p. 278, pl. lv., fig. 13.

‡ Vol. v., p. 283.

of the Brachiopoda being much further increased from Scottish Carboniferous strata. Still, there is reason to hope that, as new localities are opened up, some of the Carboniferous forms found elsewhere in Britain may yet be found within the area of our coal-fields. There is, however, more important work still to be done amongst this class of organisms than the finding of new genera and species, and that is, in trying to discover amongst certain of the genera better preserved examples of the species showing the internal muscular impressions and other interior characters; likewise, in trying to discover in the more perfectly preserved examples of other species what were the external characters on the surface shell, as also the nature of the perforations, where such exist, in the shell-structure. Already Dr. Davidson has been able to throw much light on some of these points from the study of Scottish specimens, which often have their shell-structure better preserved than in examples obtained from the English and Irish limestones, in which the shells are found to be often much altered by crystallization or other metamorphic changes.

In preparing the following list of genera and species of the Carboniferous Brachiopoda found in Scotland, I have consulted for the Calciferous division of the strata the list given in Dr. Bryce's "Geology of Arran";\* the papers of Mr. Robert Etheridge, jun., "On Lower Carboniferous Invertebrata"; † and that of Mr. J. W. Kirkby "On the Zones of Marine Fossils in the Calciferous Sandstones of Fife." ‡ For those of the lower and upper limestone strata, millstone grit, and upper coal-measures, I have consulted the lists in Dr. Davidson's monograph, "Catalogue of Western Scottish Fossils," "Explanations of Sheets 23 and 31 of the Geological Survey Map, Geological Survey Memoirs, 1873-1879," and the various papers in the *Transactions* of this Society which contain lists of Carboniferous Fossils.

\* Fourth edition, 1872, p. 225.

† *Quarterly Journal of the Geological Society*, 1878, vol. xxxiv., p. 23.

‡ *Ib.*, 1880, vol. xxxvi., p. 588.

REVISED LIST OF  
SCOTTISH CARBONIFEROUS BRACHIOPODA, 1885.

GENERA AND SPECIES.	Califerous Sandstone Series.	Lower Carb. Limestone Series.	Upper Carb. Limestone Series.	Millstone Grit Series.	Coal Measures.
TRETENTERATA.— <i>King</i> .					
<i>Lingula mytiloides</i> , Low.	x	x	x	x	x
,, <i>squamiformis</i> , Phill.	x	x	x	x	x
,, <i>Scotica</i> , Dav.		x	x		
,, (?) <i>Thomsoni</i> , Dav.		x			
<i>Discina nitida</i> , Phill.	x	x	x	x	x
,, <i>Craigii</i> , Dav.		x	x		
<i>Crania quadrata</i> , M'Coy.		x	x		
CLISTENTERATA.— <i>King</i> .					
<i>Dielasma (Terebratula) hastata</i> , Sow.	x	x	x		
,, ,, <i>sacculus</i> , Mart.		x	x		
,, ,, <i>vesicularis</i> , De Kon.		x	x		
,, ,, <i>Gillingensis</i> , Dav.		x			
<i>Spirifera duplicicosta</i> , Phill.	x	x			
,, <i>triangularis</i> (?), Mart.			x		
,, <i>trigonalis</i> , Mart.	x	x	x		
,, ,, var. <i>bisulcata</i> , Sow.	x	x	x		
,, <i>triradialis</i> , Phill.		x			
<i>Martinia (Spirifera) globra</i> , Mart.		x	x		
,, ,, <i>ovalis</i> , Phill.	x	x			
,, ,, <i>Urei</i> , Flem.	x	x	x		
,, ,, <i>Carlukensis</i> , Dav.		x	x		
<i>Reticularia (Spirifera) lineata</i> , Mart.	x	x	x		
<i>Spiriferina cristata</i> var. <i>octoplicata</i> , Sow.	x	x	x		
,, <i>insculpta</i> , Phill.			x		
,, <i>laminosa</i> , M'Coy.	x	x			
,, <i>Etheridgei</i> , Dav.		x			
<i>Athyris ambigua</i> , Sow.	x	x	x		
,, <i>plano-sulcata</i> , Phill.		x	x		
,, <i>Royssii</i> , Leveillé.	x	x	x		
,, <i>pisum</i> , Dav.		x	x		
<i>Retzia radialis</i> , Phill.	x	x	x		
<i>Rhynchopora Youngii</i> , Dav.		x	x		

GENERA AND SPECIES.	Calcareous Sandstone Series.	Lower Carb. Limestone Series.	Upper Carb. Limestone Series.	Millstone Grit Series.	Coal Measures.
<i>Camarophoria crumena</i> , Mart.		x			
<i>globulina</i> , Phill.		x			
<i>Rhynchonella pleurodon</i> , Phill.	x	x	x		
<i>pugnus</i> , Mart.		x	x		
<i>Brockleyensis</i> , Dav.		x			
<i>Orthis resupinata</i> , Mart.	x	x	x	x	
<i>Michelini</i> , Leveillé.		x	x		
<i>Streptorhynchus crenistria</i> , Phill.	x	x	x	x	
"    "    var. <i>radialis</i> , Phill.		x	x		
"    "    var. <i>senilis</i> , Phill.			x		
"    "    var. <i>cylindrica</i> , M'Coy.		x	x		
<i>Strophomena rhomboidalis</i> var. <i>analoga</i> , Phill.	x	x	x		
"    "    var. <i>distorta</i> , Sow.			x		
<i>Productus giganteus</i> , Mart.	x	x	x		
" <i>latissimus</i> , Sow.	x	x	x		
" <i>cora</i> , D'Orb.	x	x	x		
" <i>semireticulatus</i> , Mart.	x	x	x		
"    "    var. <i>Martini</i> , Sow.	x	x	x		
"    "    var. <i>concinnus</i> , Sow.	x	x			
"    "    var. <i>Scoticus</i> , Sow.		x			
" <i>costatus</i> , Sow.	x	x	x		
"    "    var. <i>muricatus</i> , Phill.		x	x		
" <i>scabriculus</i> , Mart.	x	x	x		x
" <i>pustulosus</i> (?), Phill.		x			
" <i>carbonarius</i> , De Kon.			x		
" <i>longispinus</i> , Sow.	x	x	x		
" <i>Griffithianus</i> , De Kon.		x			
" <i>sinuatus</i> , De Kon.			x		
" <i>imbriatus</i> , Sow.		x			
" <i>aculeatus</i> , Mart.	x	x	x		
" <i>Youngianus</i> , Dav.	x	x	x		
" <i>punctatus</i> , Mart.	x	x	x		
"    "    var. <i>elegans</i> , M'Coy.		x	x		
" <i>undatus</i> , DeFr.		x	x		
" <i>mesolobus</i> , Phill.		x			
" <i>spinulosus</i> , Sow.		x			
" <i>Deshayesianus</i> (?), De Kon.		x			
" <i>complectens</i> , R. Ether., jun.		x			
<i>Chonetes Laguessiana</i> , De Kon.	x	x	x		
"    "    var. <i>gibberula</i> , M'Coy.		x			
" <i>Buchiana</i> , De Kon.		x	x		
" <i>polita</i> , M'Coy.	x	x	x		
<i>Aulacorhynchus Davidsoni</i> , Barrois.		x			
Total number of species found in each series,	33	67	52	5	4